

4 Environmental Consequences

4.1 Introduction

This section describes the environmental consequences associated with the alternatives. It is organized by impact topic, which distills the issues and concerns into distinct subjects for discussion analysis. NEPA requires consideration of context, intensity, and duration of adverse and beneficial impacts (direct, indirect, and cumulative) and measures to mitigate for impacts. NPS policy also requires that impairment of resources be evaluated in all environmental documents; therefore, this discussion is also included for each impact topic.

4.2 Methodology for Assessing Impacts

As required by NEPA, potential impacts are described in terms of type (beneficial or adverse), context (site-specific, local, or regional), duration (short-term or long-term), and level of intensity (negligible, minor, moderate, or major). The CEQ regulations that implement NEPA require assessment of impacts to cultural as well as natural resources. In this DCP/EA/AOE, impacts to cultural resources are described in terms of type, context, duration, and intensity, as described above, which is consistent with the regulations of the CEQ that implement NEPA.

This DCP/EA/AOE is also being used to comply with the requirements of Sections 106 and 110 of the National Historic Preservation Act. The CEQ regulations that implement NEPA require assessment of impacts to cultural as well as natural resources. These impact analyses are intended, however, to comply with the requirements of both NEPA and Section 106 of the NHPA. In accordance with the regulations implementing Section 106 and 110 of the NHPA (36 CFR Part 800, *Protection of Historic Properties*, and 36 CFR Part 800, respectively), impacts to archeological and cultural resources were identified and evaluated by (1) determining the area of potential effects; (2) identifying cultural resources present in the area of potential effects that were either listed on or eligible for listing on the National Register of Historic Places; (3) applying the criteria of adverse effect to affected cultural resources either listed on or eligible for listing on the National Register; and (4) considering ways to avoid, minimize, or mitigate adverse effects.

Overall, these impact analyses and conclusions were based on the review of existing literature and Colonial NHP studies, information provided by experts within the park and other agencies, professional judgments and park staff insights, consultations with the Virginia State Historic Preservation Officer (SHPO), and public input.

Type

Beneficial: A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.

Adverse: A change that moves the resource away from a desired condition or detracts from its appearance or condition.

Direct: An impact that is caused by an action and occurs at the same time and place.

Indirect: An impact that is caused by an action but is later in time or farther removed in the distance, but still reasonably foreseeable.

Context

Context is the setting within which an impact is analyzed.

Site-specific: The impact would affect the project site.

Local: The impact would affect the park.

Regional: The impact would affect localities, cities, or towns surrounding the park.

Duration

For all resources and values, the duration of impacts in this document is defined as follows:

Short-term: Impacts that occur only during construction or last less than one year.

Long-term: Impacts that last longer than one year.

Level of Intensity

Because level of intensity definitions (negligible, minor, moderate, or major) vary by impact topic, they are provided separately for each impact topic.

Impairment

In addition to determining the environmental consequences of the preferred and other alternatives, *NPS Management Policies 2001* (NPS 2000) and *Director's Order 12: Conservation Planning, Environmental Impact Analysis and Decision-Making*, require analysis of potential impacts to determine whether or not actions would impair park resources.

A fundamental purpose of the NPS, as provided for in its Organic Act (1916) and reaffirmed by the General Authorities Act (1970), as amended in 1978, begins with a mandate to conserve park resources and values. However, the laws do give the NPS the management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of the park, as long as the impact does not constitute impairment of the affected resources and values. Although Congress has given the NPS the management discretion to allow certain impacts within parks, that discretion is limited by the statutory requirement that the NPS must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise. The prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values, including opportunities that otherwise would be present for the enjoyment of those resources and values. An impact would be more likely to constitute impairment to the extent it affects a resource or value whose conservation is:

- (1) Necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park;
- (2) Key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or
- (3) Identified as a goal in the park's general management plan or other relevant NPS planning documents.

Impairment may result not only from NPS activities in managing the park, but also visitor activities or activities undertaken by concessionaires, contractors, and others operating in the park. An impairment determination is provided for each impact topic, where appropriate, within the conclusion section of each alternative.

Cumulative Impacts

Impacts can be direct, indirect, or cumulative. As previously noted, direct impacts are caused by an action and occur at the same time and place as the action, while indirect impacts are caused by the action and occur later or farther away but are still reasonably foreseeable. The CEQ regulations, that implement NEPA, require assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as impacts which result when the impact of the proposed action is added to the impacts of other present and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions (40 CFR 1508.7).

To determine the potential cumulative impacts, existing and future projects at Colonial NHP and in the surrounding area were identified. These included lands administered by the NPS; the Commonwealth of Virginia; James City County, Virginia; and the City of Williamsburg, Virginia. Projects were determined by meetings and phone calls with county and town governments and state land managers. Potential projects identified as cumulative actions included any planning or development activity that was currently being implemented or that would be implemented in the reasonably foreseeable future.

These cumulative actions are evaluated in the cumulative impact analysis in conjunction with the impacts of a particular natural resource, cultural resource, visitor use, or the socioeconomic environment. Because some of these cumulative actions are in the early planning stages, the evaluation of cumulative impacts was based on a general description of the project. Cumulative impacts are considered for all alternatives and are presented at the end of each impact topic discussion. Following is a list of projects identified to determine cumulative impacts:

James City County Greenway Master Plan

The Greenway Master Plan is a developing project. The goal of this project is to tie together significant cultural and natural features with local communities through an integrated system of open space, trails, and bikeways. Green Spring is in the core of several of these systems. Included within these greenways and trails are the Commonwealth of Virginia's proposed Capital to Capital Bikeway that would stretch from Richmond to Williamsburg, the TransAmerica Bike Route, and the Williamsburg Historic Necklace multiuse trail. These plans are outlined in the *Virginia Outdoor Plan* (VDCR 1996) and use Route 5 (south of Green Spring) as a major artery. The proximity of Route 5 to Green Spring creates the potential for trails and bikeways to pass through Green Spring. The NPS would prefer that these trails remained outside the unit's boundary but will cooperate with James City County to determine the best alternative for these routes. These projects would have the potential to impact soils, vegetation, wildlife and wildlife habitat, special status species, wetlands, water quality, cultural landscapes, visual resources, and visitor use and experience, as well as circulation and site access.

The Jamestown Project

The Jamestown Project, administered by the NPS and the Association for the Preservation of Virginia Antiquities (APVA), is currently in the design and implementation stage. The project is designed to better research, protect, and present the resources at Jamestown to the public. Efforts to reach this goal include improving the quality of visitor experience, enhancing research and educational opportunities, and protecting associated collections and archival materials. The development of an interpretive facility at Green Spring would tie directly to the mission of the Jamestown Project (Colonial NHP 2003). This project would have the potential to impact soils and topography, vegetation, wildlife and wildlife habitat, special status species, wetlands, water quality, Chesapeake Bay Preservation Areas, archeological resources, historic structures, cultural landscapes, visual resources, visitor use and experience, and circulation and site access, as well as park operations and infrastructure.

Colonial National Historical Park Alternative Transportation System (ATS) Study

In 2001, Colonial NHP produced an *Alternative Transportation System Study*. This study made recommendations for an alternative transportation system that would lessen the impact of increased automobile traffic, provide enhanced visitor experiences, and protect the structural integrity of the Colonial Parkway and adjacent structures. Recommendations from this study include a multi-jurisdictional regional public transportation system that would integrate local ATS options throughout Colonial NHP (Colonial NHP 2003). Green Spring was considered as a stop on the route, but would not be included on the main Parkway transit service or the Historic *Jamestowne* shuttle. A separate route would be developed for Green Spring to provide access for special events or if

visitation levels began to regularly exceed the site's parking capacity. The study phase of this project is now complete, and the park has moved to the NEPA and implementation phases. The project would have the potential to impact visitor use and experience, circulation and site access, as well as operations and infrastructure.

The Jamestown Settlement

The Jamestown-Yorktown Foundation (JYF) was designated by the Commonwealth of Virginia to coordinate the state's observance of Jamestown's 400th anniversary. The JYF also operates the state's living history museum at the Jamestown Settlement, which is located in close proximity to both Green Spring and the Jamestown unit of Colonial NHP. Currently, the facilities at the Jamestown Settlement are being improved in preparation of Jamestown's 400th anniversary. These improvements include a new education building, a welcome café, expanded parking, and a new museum and monument. Additional work is underway to coordinate with the NPS and the APVA to relocate State Route 359. This road currently separates the Settlement from its parking lot and connects Jamestown Road to the Colonial Parkway. These projects would have the potential to impact soils and topography, vegetation, wildlife and wildlife habitat, special status species, wetlands, water quality, Chesapeake Bay Preservation Areas, archeological resources, historic structures, cultural landscapes, visual resources, visitor use and experience, and circulation and site access.

Future Development of Green Spring

As described earlier in this document, this proposed project is based on elements of the *Green Spring Final General Management Plan Amendment/Abbreviated Final Environmental Impact Statement*. The GMP outlined other plans for Green Spring that were not incorporated in this project. Future projects at Green Spring could be designed to incorporate elements from the GMPA/EIS that were not included in this project. Some of these elements include working with VDOT to close Centerville Road and relocating the visitor support facilities to a permanent location on the east side of Green Spring. Closing the road would bring more unity to the site and allow for improved vegetative management. These elements have the potential to impact soils and topography, vegetation, wildlife and wildlife habitat, special status species, wetlands, water quality, Chesapeake Bay Preservation Areas, archeological resources, cultural landscapes, visual resources, lightscapes, visitor use and experience, circulation and site access; as well as park operations, infrastructure, and community services.

4.3 Physical and Natural Resources

4.3.1 Soils and Topography

Methodology

All available information on soils and topography potentially impacted in various areas of the park was compiled for this document. Where possible, map locations of sensitive soils were compared with locations of proposed developments and modifications of existing facilities. Predictions about short- and long-term site impacts were based on previous projects with similar soils and recent studies. The thresholds of change for the intensity of an impact are defined as follows:

- Negligible: Soils and/or topography would not be affected or the impacts to soils and/or topography would be below or at the lower levels of detection. Any impacts to soils would be slight.
- Minor: The impacts to soils and/or topography would be detectable, and impacts to soil area and/or topography would be small. Mitigation may be needed to offset adverse impacts and would be relatively simple to implement and likely be successful.
- Moderate: The impacts on soils and/or topography would be readily apparent and result in a change to the soil character and/or topography over a relatively wide area. Mitigation measures would be necessary to offset adverse impacts and likely be successful.
- Major: The impacts on soils and/or topography would be readily apparent and would substantially change the character of the soils and/or topography over a large area in and out of the park. Mitigation measures to offset adverse impacts would be needed, extensive, and their success could not be guaranteed.

Impacts of No Action

This alternative does not involve any new construction or improvements at the site that would alter soils or topography. However, continued use of the site for archeological research and special events could lead to the formation of informal paths. These paths could experience soil loss from erosion, and foot traffic could cause some compaction of soils over time. There would also be no loss of prime farmland soils. The overall impact to soils and topography would be long-term, minor, and adverse.

Impacts of Alternative 2 (NPS Preferred Alternative)

Approximately 1.98 acres of soil would be disturbed by the proposed project. This would include area for the BMP, where approximately 6,000-9,000 cubic feet of soil would be removed. Most of it would be replaced with other materials. Approximately 1.87 acres would be made impermeable through the construction of the access road, parking area, and facilities. The remaining disturbance would be comprised of the BMP and trail, both of which would be permeable.

Construction of the impermeable access road, parking area, and three facilities would require minimal excavation of current soils. The majority of impacts to soils for these activities would come from soil movement and grading to prepare the site for development. Within the 45-foot access road swath, a three to four foot deep trench would be dug to provide access for utilities to the site. This trench would temporarily displace soils that would be replaced upon completion of the project. .

Construction of the trail would require grading and soil movement. Because the trail surface would be permeable, it would not take away from the soil's ability to absorb stormwater runoff. Grading around the trail would strengthen soils and reduce runoff and erosion. Wet soils around the spring area would be avoided through the construction of a boardwalk.

The construction of the BMP would require the excavation of two to three feet of soil. Most of this excavated soil would be replaced with soil/sand/loam mix; however, the upper four to six inches would be filled in with the excavated soil. The soil/sand/loam mix would improve the functions of soils in mitigating stormwater runoff. The construction of the trail would also require soil disturbance and movement during construction. The trail would not improve the soil's ability to handle stormwater runoff, but would allow water to be absorbed by the soil rather than washing over the surface. The grading required for the trail would protect soils from erosion and compaction.

Overall, 1.98 acres of soils would be impacted by this project. Prior to development of the site the NPS would coordinate with the Colonial Soil and Water Conservation District to re-evaluate the prime farmland designation. A conservation plan would also be developed to manage these soils and prevent further adverse impacts. Based on the temporary nature of the buildings, the only construction that would displace prime farmland soils would be through the trail, entranceway, parking lot, and BMP. The prime farmland soil removed from these areas could be stockpiled on site and spread over other portions of the Green Spring unit. The overall impact would be long-term, minor, and adverse. However, if the project team chooses to construct the parking and access road with gravel, the impact would be much less.

Impacts of Alternative 3

Approximately 1.25 acres of soil would be disturbed by the proposed project. This would include area for the BMP, where approximately 6,000-9,000 cubic feet of soil would be removed. Most of it would be replaced with other materials. Of this overall disturbance, 1.11 acres of which would be made impermeable through the construction of the parking area and facilities. The remaining disturbance would be comprised of the BMP and trail, both of which would be permeable.

Construction of the impermeable parking area and at the facility would require minimal excavation of current soils. The majority of impacts to soils for these activities would come from soil movement and grading to prepare the site for development. Under this alternative, a utility trench is not needed.

Construction of the trail would require grading and soil movement. Because the trail surface would be permeable, it would not take away from the soil's ability to absorb stormwater runoff. Grading around the trail would strengthen soils and reduce runoff and erosion. Wet soils around the spring area would be avoided through the construction of a boardwalk.

The construction of the BMP would require two to three feet of soil be excavated. Most of this excavated soil would be replaced with soil/sand/loam mix; however, the upper four to six inches would be replaced with the excavated soil. The soil/sand/loam mix would improve the functions of soils in mitigating stormwater runoff. The construction of the trail would also require soil disturbance and movement during construction. The trail would not improve the soil's ability to handle stormwater runoff, but would allow water to be absorbed by the soil rather than washing over the surface. The grading required for the trail would protect soils from erosion and compaction.

Overall, 1.25 acres of soils would be impacted by this project. Prior to development of the site the NPS would coordinate with the Colonial Soil and Water Conservation District to re-evaluate the prime

farmland designation. A conservation plan would also be developed to manage these soils and prevent further adverse impacts. Based on the temporary nature of the buildings, most topsoil onsite would be undisturbed. The only construction that would displace prime farmland soils would be through the trail, entranceway, parking lot, and BMP. The prime farmland soil removed from these areas could be stockpiled on site and spread over other portions of the Green Spring unit. The overall impact would be adverse and beneficial, minor, and long-term. However, if the project team chooses to construct the parking area with gravel, the impact would be much less.

Cumulative Impacts

Non-federal and federal actions that have occurred on adjacent lands, in combination with future actions at Colonial NHP, have resulted in and would continue to result in soil loss and conversion of prime farmlands throughout the region. Present and reasonably foreseeable future actions that would have an impact on soils and/or topography within the park include long-term, minor, adverse and beneficial impacts from the James City County Greenway Master Plan, long-term, minor, adverse impacts from the Jamestown Project and the Jamestown Settlement, and long-term, minor, adverse and beneficial impacts from future developments of Green Spring. The trail development would require grading and soil displacement. Although this would disturb the natural soil composition it would reduce runoff and erosion. The Jamestown Project and Jamestown Settlement would introduce new impervious and pervious surfaces, as well as improved BMPs. The overall impact from these projects would be long-term, minor, and adverse. The proposed alternatives would contribute noticeable increments to these long-term, minor, adverse cumulative impacts.

Conclusion

The overall impact to soils and topography under the alternatives presented above would be **long-term, minor, and adverse**. These alternatives would contribute noticeable increments to long-term, minor, adverse cumulative impacts to soils and topography. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the park's establishing legislation, (2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents, there would be no impairment of park resources or values related to soils and topography.

4.3.2 Vegetation

Methodology

All available information on vegetation and vegetative communities potentially impacted in Colonial NHP was compiled for this document. Where possible, map locations of sensitive vegetation species, populations, and communities were identified and avoided. Predictions about short- and long-term site impacts were based on recent studies and previous projects with similar vegetation. The thresholds of change for the intensity of an impact are defined as follows:

- Negligible:** No native vegetation would be affected or some individual native plants could be affected as a result of the alternative, but there would be no impact on native species populations. The impacts would be on a small scale, and no species of special concern would be affected.
- Minor:** The alternative would affect some individual native plants and would also affect a relatively minor portion of that species' population. Mitigation to offset adverse impacts, including special measures to avoid affecting species of special concern, could be required and would be effective.
- Moderate:** The alternative would affect some individual native plants and would also affect a sizeable segment of the species' population over a relatively large area. Mitigation to offset adverse impacts could be extensive but would likely be successful. Some species of special concern could also be affected.
- Major:** The alternative would have a considerable impact on native plant populations, including species of special concern, and affect a relatively large area in and out of the park. Mitigation measures to offset the adverse impacts would be required and extensive, and success of the mitigation measures would not be guaranteed.

Impacts of Alternative 1 (No Action)

Under Alternative 1, conditions would remain the same, and there would be no change in the current vegetation management strategy. The practice of no active management in the woodlands would continue, and open areas would be maintained as grass or tall grassland fields by semi-annual mowing. Informal trails would continue to form across the site as archeological resources were accessed, wearing away grass and other groundcovers. Over the long-term, exotic vegetation could expand across the site and create a minor displacement of native vegetation. The overall impact to vegetation would be long-term, negligible, and adverse.

Impacts of Alternative 2 (NPS Preferred Alternative)

Constructing visitor contact buildings and a parking area would remove approximately 1.38 acres of wooded vegetation. This would include the wooded area cleared for the access road and utility trench. Species that would be affected include primarily eastern red cedar and Virginia pine. However, individual stems of sweet gum would also be removed. The trees that would be impacted by the project do not have historical significance and likely grew up or were planted within the last 50 years. Furthermore, the project area has a low habitat value.

In addition, 0.6 acre of grass habitat would be eliminated by constructing the access road and trail. The majority of the open fields that exist adjacent to the project area would remain open fields. Vegetation associated with Green Spring's ephemeral ponds fall outside the project area. Some vegetation associated with the wet area in the southern portion of the site would be impacted by trail design. These impacts would be confined primarily to eight small trees. All of these trees are between three to six inches in diameter and their loss would not impact the vegetative community. Other impacts in the wet area include

the removal of dead trees and storm debris and the removal of some vines. Over the long-term, exotic vegetation could expand across the site. The design would include mulch and shrubbery planted along the parking area and buildings. A grass mix would be planted along the road and a mowing strip would be established to keep invasives down. Based on the increased attention given to the site under this alternative, more action would be taken to control and/or eliminate these exotic species. Alternative 2 would have a long-term, minor, adverse impact on vegetation.

Impacts of Alternative 3

Alternative 3 would remove approximately 1.25 acres of grass habitat. This is a smaller area than Alternative 2, as it is a smaller site that requires less access or utility work. Consequently, no forested space would be lost under this alternative. However, visitor contact facilities and parking in Alternative 3 would be situated closer to sensitive natural resources, including forested wetlands, but the alternative would not directly impact these resources. Some vegetation associated with the wet area in the southern portion of the site would be impacted by trail design. These impacts would be confined primarily to eight small trees. All of these trees are between three to six inches in diameter and their loss would not impact the vegetative community. Other impacts in the wet area include the removal of dead trees and storm debris and the removal of some vines. As in the other alternatives, over the long-term, exotic vegetation could expand across the site. The design would include mulch and shrubbery planted along the parking area and the building. A grass mix would be planted along the road and a mowing strip would be established to keep invasives down. Based on the increased attention given to the site under this alternative, more effort would be taken to control exotic species, though not as much as in Alternative 2. The impact to vegetation from Alternative 3 would be long-term, negligible, and adverse.

Cumulative Impacts

Vegetative changes and losses are occurring throughout the region primarily from urbanization and road construction and will likely continue. Present and reasonably foreseeable future actions in the area of Green Spring that would have an impact on vegetation include long-term, negligible impacts from the James City County Greenway Master Plan, long-term, minor to moderate, adverse impacts from the Jamestown Project and the work at the Jamestown Settlement, and long-term, negligible to minor, adverse and beneficial impacts from future development at Green Spring. The Greenway project could result in the loss and/or gain of vegetation in select areas to screen development or open up viewsheds. The Jamestown Project and work at the Jamestown Settlement would result in removal of vegetation to facilitate development and open up desirable viewsheds. Plantings would also occur under these projects to screen some areas and as mitigation for lost vegetation. Future development at Green Spring could remove intrusions from the road, allowing for more continuous vegetative cover. Moving the facilities to the east side of the site would require some additional impacts to vegetation. The overall impact from these projects would be long-term, minor to moderate, and adverse. The No Action Alternative and Alternative 3 would contribute imperceptible increments to these impacts, while Alternative 2 would contribute noticeable increments to long-term, minor to moderate, adverse cumulative impacts.

Conclusion

The overall impact to vegetation from the No Action Alternative would be **long-term and negligible**. Alternative 2 would have a **long-term, minor adverse impact** to vegetation. Alternative 3 would have a **long-term, negligible, adverse impact** to vegetation. The No Action Alternative and Alternative 3 would contribute imperceptible increments to cumulative impacts. Alternative 2 would contribute noticeable increments to long-term, minor to moderate, adverse cumulative impacts. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the park's establishing legislation, (2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents, there would be no impairment of park resources or values related to vegetation.

4.3.3 Wildlife and Wildlife Habitat

Methodology

The NPS Organic Act, which directs parks to conserve wildlife unimpaired for future generations, is interpreted by the agency to mean that native animal life should be protected and perpetuated as part of the park's natural ecosystem. Natural processes are relied on to control populations of native species to the greatest extent possible; otherwise they are protected from harvest, harassment, or harm by human activities. According to *NPS Management Policies 2001* (NPS 2000), the restoration of native species is a high priority (sec. 4.1). Management goals for wildlife include maintaining components and processes of naturally evolving park ecosystems, including natural abundance, diversity, and the ecological integrity of plants and animals. Information on Green Spring wildlife was taken from park documents and records for this document. The Colonial NHP natural resource management staff, the U.S. Fish and Wildlife Service, and the Virginia Department of Game and Inland Fisheries also provided wildlife information. The thresholds of impact are as follows:

- Negligible: There would be no observable or measurable impacts to native species, their habitats, or the natural processes sustaining them. Impacts would be of short duration and well within natural fluctuations.
- Minor: Impacts would be detectable, but they would not be expected to be outside the natural range of variability and would not be expected to have any long-term impacts on native species, their habitats, or the natural processes sustaining them. Mitigation measures, if needed to offset adverse impacts, would be simple and successful.
- Moderate: Breeding animals of concern are present; animals are present during particularly vulnerable life-stages, such as migration or juvenile stages; mortality or interference with activities necessary for survival can be expected on an occasional basis, but is not expected to threaten the continued existence of the species in the park unit. Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, and they could be

outside the natural range of variability for short periods of time. Mitigation measures, if needed to offset adverse impacts, would be extensive and likely successful.

Major: Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, and they would be expected to be outside the natural range of variability for long periods of time or permanent. Loss of habitat might affect the viability of at least some native species. Extensive mitigation measures would be needed to offset any adverse impacts, and their success would not be guaranteed.

Impacts of Alternative 1 (No Action)

No improvements would be made to the site that would impact wildlife. However, footpaths would continue to develop as researchers and a limited number of visitors cross the site. As a result, insects and small mammals that inhabit the grass would be displaced as the vegetation is worn away. There would be no impact to wildlife and wildlife habitat under this alternative.

Impacts of Alternative 2 (NPS Preferred Alternative)

Under Alternative 2, approximately 1.38 acres of wooded habitat would be removed. This would include area cleared for the new buildings, parking area, trail, access road, and utility trench. The area is likely used by a variety of wildlife species including small mammals, such as rabbits and mice; likewise, songbirds, such as wrens, cardinals, robins, and sparrows seek this habitat type for food and nesting. Despite this variety of wildlife, the area possesses low habitat value. In addition, a small amount of the open grass area would be removed by the construction of an entrance road. This would displace insects and small mammals that prefer the grass setting. In both cases, however, the areas that would be disturbed are immediately surrounded by habitat with the same characteristics, and local populations would easily find a similar environment. The overall impact would be long-term, minor, and adverse.

Impacts of Alternative 3

Approximately 1.25 acres of grass habitat would be removed for construction of the visitor support facilities. No forest habitat would be impacted under this alternative. Small mammals and insects that prefer grass habitat would be displaced but could find cover in adjacent areas. Developing a trail across the site would also remove small amounts of this habitat. The overall impact to wildlife and wildlife habitat would be long-term, minor, and adverse.

Cumulative Impacts

Commercial and residential development projects in the area of Colonial NHP continue to result in a reduction of wildlife habitat in the region and the subsequent displacement of species. Projects that could contribute to this impact include long-term, negligible impacts from the James City County Greenway Master Plan; long-term, minor to moderate, adverse impacts from the Jamestown Project and the Jamestown Settlement, as well as long-term, minor, adverse and beneficial impacts from future development at Green Spring. The greenway project could remove some habitat and introduce occasional human interference to areas that were previously

undisturbed. The Jamestown Project and Jamestown Settlement would create similar impacts, but on a larger scale. The future development at Green Spring would displace some habitats and species, and also introduce human interference to a larger portion of the site. It would, however, create a more unified grassy habitat, by removing regular vehicular traffic from Centerville Road. Overall, these projects would have long-term, minor, adverse impact. The No Action Alternative would contribute imperceptible increments to these impacts, while the action alternatives would contribute noticeable increments to long-term, minor, adverse cumulative impacts.

Conclusion

The No Action Alternative would have a **long-term, negligible impact** on wildlife and wildlife habitat and would contribute imperceptible increments to cumulative impacts on these resources. Alternative 2 and 3, however, would have **long-term, minor, adverse impacts** on wildlife and wildlife habitat and would contribute noticeable increments to long-term, minor, adverse cumulative impacts. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the park's establishing legislation, (2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents, there would be no impairment of park resources or values related to wildlife and wildlife habitat.

4.3.4 Special Status Species

Methodology

The Endangered Species Act (16 USC 1531 et seq.) mandates that all federal agencies consider the potential impacts of their actions on species listed as threatened or endangered. If the National Park Service determines that an action may adversely affect a federally listed species, consultation with the FWS is required to ensure that the action will not jeopardize the species' continued existence or result in the destruction or adverse modification of critical habitat. *NPS Management Policies 2001* states that potential impacts of agencies actions will also be considered on state or locally listed species. The NPS is required to control access to critical habitat of such species, and to perpetuate the natural distribution and abundance of these species and the ecosystems upon which they depend. The FWS and VDGIF were contacted for a list of special status species and designated critical habitats that may be within the project area or affected by any of the alternatives. Information on possible threatened, endangered, candidate species, and species of special concern was gathered from past Colonial NHP studies and plans, as well as the VDGIF information service. Information from prior research at Green Spring was also incorporated. Map locations of habitat associated with threatened, endangered, candidate species, and species of special concern were compared with locations of proposed developments and existing facilities. Known impacts caused by development and human uses were also considered. The thresholds of change for the intensity of an impact are as follows:

- Negligible: The action could result in a change to a population or individuals of a species or designated critical habitat, but the change would be so small that it would not be of any measurable or perceptible consequence.
- Minor: The action could result in a change to a population or individuals of a species or designated critical habitat. The change would be measurable but small and localized and of little consequence.
- Moderate: The action would result in some change to a population or individuals of a species or designated critical habitat. The change would be measurable and of consequence.
- Major: The action would result in a noticeable change to a population or individuals of a species or resource or designated critical habitat.

Impacts of Alternative 1 (No Action)

Under the No Action Alternative, no changes would be made to the current management of the Green Spring site that would affect special status species. The bald eagle buffer would continue to remain untouched and the Mabee's Salamander critical habitat would remain fragmented. Habitat would continue to exist for other transient species to temporarily inhabit Green Spring. The potential for special status floral species to colonize the unit would remain. The No Action Alternative would have no impact on special status species.

Impacts of Alternative 2 (NPS Preferred Alternative)

Under the NPS Preferred Alternative, development would occur in areas of low habitat value. The project area would be approximately 100 feet away from the suggested bald eagle buffer, far away from the mandatory buffer. It would also be relatively close to the Mabee's Salamander critical habitat, 700-750 feet. Although the project area comes close to the ephemeral pond habitat, it would not result in the loss of any of the salamander's habitat. Based on the salamander's delicate nature, it cannot leave this habitat. Young salamanders do not leave the water. Older individuals may leave the water, but can not stray far nor leave shaded areas, as their skin cannot protect them from the sun. Because the salamander does not leave this area, and the project development does not enter the habitat, the salamander would not be impacted by this project. Based on the low habitat value of the project area and the common nature of the species that exist within it, no impacts to the transient special status species would occur. Finally, the project area is not located along the edge of the Green Spring unit. Therefore, there would no impacts to those floral species found in neighboring tracts, such as the small whorled pogonia. The Preferred Alternative would have no impact on special status species.

Impacts of Alternative 3

Under the NPS Preferred Alternative, development would occur in areas of low habitat value. The project area would be farther from the suggested bald eagle buffer than the preferred alternative, 650-700 feet away. It would, however, be much closer to the Mabee's Salamander critical habitat than the preferred

alternative, 250 – 320 feet. Although the project area comes close to the ephemeral pond habitat, it would not result in the loss of any of the salamander's habitat. Based on the salamander's delicate nature, it cannot leave this habitat. Young salamanders do not leave the water. Older individuals may leave the water, but can not stray far nor leave shaded areas, as their skin cannot protect them from the sun. Because the salamander does not leave this area, and the project development does not enter the habitat, the salamander would not be impacted by this project. Based on the low habitat value of the project area and the common nature of the species that exist within it, no impacts to the transient special status species would occur. Also, the project area does not border neighboring tracts of land. Therefore, there would be no impacts to those floral species found in neighboring tracts, such as the small whorled pogonia. Finally, the project area under this alternative is primarily located along a heavily used road. The disturbance from this road would make it nearly impossible for special status species to exist within the project area. Alternative 3 would have no impact on special status species.

Cumulative Impacts

Past, present and reasonably foreseeable future actions have contributed cumulative impacts to special status species in and around Green Spring. Present and on-going projects in the area that could contribute to these actions include short- and long-term, negligible, adverse impacts from the greenway master plan, short- and long-term, minor, adverse impacts from the Jamestown Project and the Jamestown Settlement, long-term, negligible, adverse impacts from future development at Green Spring, as well as long-term, negligible to moderate, adverse impacts from ongoing land development throughout the region. The greenway master plan could present short-term disturbances during construction and long-term disturbances from human activities along the trails. The Jamestown Project and work at the Jamestown Settlement would create short-term impacts during construction and long-term impacts as habitats were altered, permanent structures developed in previously undisturbed areas, and new areas of human disturbance created. Future development at Green Spring would follow procedures similar to this project to ensure the site's resources were not significantly impacted. Finally, further development throughout James City County and southeast Virginia could eliminate habitat and special status species. The overall impact from these projects is long-term, negligible to moderate, and adverse. None of the alternatives presented above would contribute to these long-term, negligible to moderate, adverse cumulative impacts.

Conclusion

All of the alternatives presented above would have **no impact** on special status species and would not contribute to long-term, minor to moderate, adverse cumulative impacts on these resources. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the park's establishing legislation, (2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents, there would be no impairment of park resources or values related to special status species.

4.3.5 Wetlands

Methodology

The NPS has adopted a goal of ‘no net loss’ of wetlands and has also set goals for a long-term net gain of wetlands servicewide (NPS 2002). The planning team based the impact analysis and conclusions for possible impacts to wetlands on the on-site inspection of known and potential jurisdictional wetlands within the park, review of existing literature and studies, information provided by experts in the National Park Service and other agencies, and Colonial NHP staff insights and professional judgment. Where possible, map locations of wetlands were compared with locations of proposed developments and modifications of existing facilities. Predictions about short- and long-term site impacts were based on previous studies of impacts to wetlands from similar projects and recent scientific data.

The thresholds of change for the intensity of an impact are defined as follows:

- Negligible: Wetlands would not be affected or the impacts to the resource would be below or at the lower levels of detection.
- Minor: The impacts to wetlands would be detectable and relatively small in terms of area and the nature of the change. The action would affect a limited number of individuals of plant or wildlife species within the wetland.
- Moderate: The impacts to wetlands would be readily apparent over a relatively small area but the impact could be mitigated by restoring previously degraded wetlands. The action would have a measurable impact on plant or wildlife species within the wetland, but all species would remain indefinitely viable.
- Major: The impacts to wetlands would be readily apparent over a relatively large area. The action would have measurable consequences for the wetland area that could not be mitigated. Wetland species dynamics would be upset, and plant and/or animal species would be at risk of extirpation from the area.

Impacts of Alternative 1 (No Action)

Under Alternative 1, no development associated with this project would occur at Green Spring. Forested buffers around the wetlands would remain intact and species that inhabit these areas would not be disturbed by on-site activity. The No Action Alternative would have no impact on wetlands.

Impacts of Alternative 2 (NPS Preferred Alternative)

Under the NPS Preferred Alternative, the new facilities would be kept out of delineated wetlands and wetland buffers (Figure 3). They would be 700 - 750 feet south of the ephemeral pond critical habitat and approximately 1,200 feet east of the nearest stream. Despite these distances, appropriate flagging, erosion

and sediment controls, and properly planned construction practices would still be used to avoid impacts to wetlands at Green Spring. Trail construction, however, could approach wet areas around the spring. The trail swath provides some room to avoid these areas. However, where it is impossible to avoid wet areas, a boardwalk would be constructed to traverse these wet areas. Temporary impacts associated with the post and plank layout would occur as the boardwalk was constructed. Based on the relatively small size of the project, no heavy equipment would be required for boardwalk construction. However, installing posts and planks could result in the loss of minimal numbers of plants. After construction the boardwalk would not create any noticeable impacts to these wet areas. The one isolated wetland identified by the Army Corps confirmation would be avoided. Overall this alternative would have a short-term, minor, adverse impact to wetlands.

Impacts of Alternative 3

Under the NPS Preferred Alternative, the new facility would be kept far from any delineated wetlands. The facility would be 250-320 feet southeast of the ephemeral pond critical habitat and 1270-1350 feet east of the nearest stream. Despite these distances, appropriate flagging, erosion and sediment controls, and properly planned construction practices would still be used to avoid impacts to wetlands at Green Spring. Trail construction, however, could approach wet areas around the spring. The trail swath provides some room to avoid these areas. However, if it is impossible to avoid wet areas, the trail would be constructed as a boardwalk to avoid wet areas. Temporary impacts would occur as the boardwalk was constructed. These impacts would be associated with posts and planks being laid out. Based on the relatively small size of the project, no heavy equipment would be required for boardwalk construction. Installing posts and planks could result in the loss of minimal numbers of plants. After construction the boardwalk would not create any noticeable impacts to these wet areas. The one isolated wetland identified by the Army Corps confirmation would be avoided. Overall this alternative would have a short-term, minor, adverse impact to wetlands.

Cumulative Impacts

Past, present and reasonably foreseeable future actions have contributed cumulative impacts to wetlands in and around Green Spring. Present and on-going projects in the area that could contribute to these actions include short-term, minor, adverse impacts from the greenway project; short- and long-term, minor, adverse impacts from the Jamestown Project and work at the Jamestown Settlement; and short-term, minor, adverse impacts from future developments at Green Spring. The greenways project would most likely be designed to avoid critical wetland habitat. However, some less sensitive areas may be impacted in a manner similar to the trail design for this project. The Jamestown Project and Jamestown Settlement may both involve water based improvements that could result in slight modifications to wetland areas (shading, boardwalks, etc). Finally, future developments at Green Spring could result in developments similar to those described for this project. Overall, these projects would have short- and long-term, minor, adverse impacts to wetlands. The No Action Alternative would not contribute to these impacts. The action alternatives would contribute noticeable increments to these short- and long-term, minor, adverse cumulative impacts.

Conclusion

The No Action Alternative would have **no impact** on wetlands and would not contribute to short- and long-term, minor, adverse cumulative impacts to wetlands. The action alternatives would have a **short-term, minor, adverse impact** on wetlands and would contribute noticeable increments to short- and long-term, minor, adverse cumulative impacts to wetlands. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the park's establishing legislation, (2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents, there would be no impairment of park resources or values related to wetlands.

4.3.6 Water Quality

Methodology

The *NPS Management Policies 2001* state that the National Park Service will "take all necessary actions to maintain or restore the quality of surface waters and ground waters within the parks consistent with the Clean Water Act and all other applicable federal, state, and local laws and regulations," (sec. 4.6.3) (NPS 2000).

A water quality standard defines the water quality goals of a water body by designating uses to be made of the water, by setting minimum criteria to protect the uses, and by preventing degradation of water quality through antidegradation provisions. The antidegradation policy is only one portion of a water quality standard. Part of this policy (40 CFR 131.12 (a) (2)) strives to maintain water quality at existing levels if it is already better than the minimum criteria. Antidegradation should not be interpreted to mean that "no degradation" can or will occur, as even in the most pristine waters, degradation may be allowed for certain pollutants as long as it is temporary and short-term.

Other considerations in assessing the magnitude of water quality impacts are the impacts on those resources dependent on a certain quality or condition of water. Sensitive aquatic organisms, submerged aquatic vegetation, riparian areas, and wetlands are affected by changes in water quality from direct and indirect sources.

Given the above water quality issues and methodology and assumptions, the following impact thresholds were established in order to describe the relative changes in water quality under the various alternatives.

- Negligible: Impacts are chemical, physical, or biological impacts that would not be detectable, would be well below water quality standards or criteria, and would be within historical or desired water quality conditions.
- Minor: Impacts (chemical, physical, or biological impacts) would be detectable but would be well below water quality standards or criteria and within historical or desired water quality conditions.

- Moderate: Impacts (chemical, physical, or biological impacts) would be detectable but would be at or below water quality standards or criteria and within historical or desired water quality conditions.
- Major: Impacts (chemical, physical, or biological impacts) would be detectable and would be frequently altered from the historical baseline or desired water quality conditions; and/or chemical, physical, or biological water quality standards or criteria would be slightly and singularly exceeded on a short-term basis.

Impacts of Alternative 1 (No Action)

Under the No Action Alternative, no changes would be made to the site that would affect water quality. Archeological investigations and natural erosion process would continue to introduce sediment to the area. However, the natural buffer at Green Spring is thick enough to absorb these pollutants before they reach any stream, pond, or wetland. The No Action Alternative would, therefore, have no impact on water quality.

Impacts of Alternative 2 (NPS Preferred Alternative)

Under the NPS Preferred Alternative, facility development would be kept out of riparian buffers that surround the ephemeral pond, nearby streams, and the site's wetlands. The area of disturbance for the new buildings would be 700-750 feet south of the ephemeral pond critical habitat and approximately 1,200 feet east of the nearest stream. The BMP would successfully mitigate the impacts created by the increased impervious surface. Trail development would also avoid these areas and be designed of porous material that would prevent increased stormwater runoff. As the trail neared the spring, it would be designed to avoid water resources as much as possible. As described under wetland impacts, if avoidance was impossible, a boardwalk would be constructed. The planks on the boardwalk would allow water to pass through without accumulating additional pollutants. This would avoid contamination of ground and surface waters in the area. The overall impact to water quality under this alternative would be long-term, negligible, and adverse.

Impacts of Alternative 3

Under Alternative 3, facility development would be kept out of riparian buffers that surround the ephemeral pond, nearby streams, and the site's wetlands. The area of disturbance for the new building would be 250-320 feet southeast of the ephemeral pond critical habitat and 1,270-1,350 feet east of the nearest stream. Trail development would also avoid these areas and be designed of porous material that would prevent increased stormwater runoff. As the trail neared the spring, it would be designed to avoid water resources as much as possible. As described under wetland impacts, if avoidance was impossible, a boardwalk would be constructed. The planks on the boardwalk would allow water to pass through without accumulating additional pollutants. This would avoid contamination of ground and surface waters in the area. The overall impact to water quality under this alternative would be long-term, negligible, and adverse.

Cumulative Impacts

Past, present and reasonably foreseeable future actions have contributed cumulative impacts to water quality in James City County. Present and on-going projects in the area that could contribute to these actions include long-term, negligible impacts from the greenway master plan; short- and long-term, minor, adverse impacts from the Jamestown Project and work at the Jamestown Settlement; and long-term, negligible to minor impacts from future development at Green Spring. The greenway master plan would introduce new trails throughout the region. If these materials were designed with porous materials, impacts to water quality would be minimal as stormwater runoff would continue to be absorbed. However, these materials could become compacted over time and increase runoff. The Jamestown Project and work at the Jamestown Settlement would introduce new impervious surfaces which could be mitigated. These projects could also create new water based development or development within a buffer that could lead to noticeable impacts to water quality. Finally, future development at Green Spring would result in additional trail work and buildings that would require similar planning described in this document. The overall impact from these projects would be long-term, negligible to minor, and adverse. The No Action Alternative would not contribute to these impacts. The action alternatives would contribute noticeable increments to long-term, negligible to minor, adverse cumulative impacts.

Conclusion

The No Action Alternative would have **no impact** on water quality and would not contribute to long-term, negligible to minor, adverse cumulative impacts on these resources. The action alternatives would have a **long-term, minor, adverse impact** on water quality and would contribute noticeable increments to long-term, negligible to minor, adverse cumulative impacts. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the park's establishing legislation, (2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents, there would be no impairment of park resources or values related to water quality.

4.3.7 Chesapeake Bay Preservation Areas

Methodology

The Chesapeake Bay Preservation Act was enacted by the Virginia Commonwealth in 1988 to regulate land use for the protection and improvement of water quality within the Chesapeake Bay. The Commonwealth has delegated the responsibility of implementing the Act to the counties and localities through their zoning ordinances and comprehensive land plans.

James City County has developed a Chesapeake Bay Preservation Ordinance in Chapter 23 of the Code of James City County. The ordinance requires the reduction of non-point source pollution associated with stormwater runoff from new impervious surfaces such as buildings, parking lots, etc. Tidal wetlands, tidal shores, nontidal wetlands connected by surface flow to tidal wetlands or tributary streams, and an adjacent 100-foot buffer area are considered RPAs, while the remainder of the county is considered RMAs. All of James City County has been designated as a Chesapeake Bay Preservation Area. Therefore,

those areas that do fall into the RPA category are considered RMAs. As a result, the county has coded requirements for reducing stormwater runoff from new impervious structures (buildings, roads, etc). To control runoff, structural BMPs, such as stormwater management facilities, are required when impervious cover exceeds 10% of the site.

The following thresholds were developed through a literature review and consultation with knowledgeable staff.

- Negligible: The disturbance would not increase the area's impervious coverage over 10% nor noticeably decrease the area's natural vegetative buffer.
- Minor: The disturbance would increase the area's impervious coverage to 10 - 15% and would decrease the area's natural buffer to extent not readily noticeable. These impacts would be successfully mitigated with a BMP.
- Moderate: The disturbance would increase the area's impervious coverage to 15 - 30% and would decrease the area's natural buffer to a noticeable extent. These impacts would be successfully mitigated with a BMP.
- Major: The disturbance would increase the area's impervious coverage to over 30% and would decrease the area's natural buffer to an extent noticeable both on land on water quality. It may be possible to mitigate these impacts with a BMP.

Impacts of Alternative 1 (No Action)

No alterations would be made to the site that would create impervious surface or impact any RPAs or RMAs. Therefore, there would be no impact to Chesapeake Bay Preservation Areas.

Impacts of Alternative 2 (NPS Preferred Alternative)

Under Alternative 2, approximately 1.87 acres of RMA would be covered by impervious surfaces. This impervious cover would increase stormwater runoff within the project area. However, a 3,000 square foot stormwater management facility would be constructed to mitigate this impact. Furthermore, the increase in impervious coverage would not surpass 10% for the entire site and the loss of vegetation, under this alternative, would not occur within a stream or wetland buffer.

Trail construction would result in the loss of eight small trees within wet areas in the southern portion of the site. These trees would be hand cut to avoid further impacts. Finally, design modifications could be made to build the parking area and/or access road in gravel rather than asphalt. As a result, Alternative 2 would have a long-term, negligible, adverse impact on Chesapeake Bay Preservation Areas.

Impacts of Alternative 3

Alternative 3 would create a smaller impervious area than Alternative 2, the NPS Preferred Alternative, approximately 1.11 acres but calls for a 3,000 square foot stormwater management facility to mitigate this impact. Furthermore, the increase in impervious coverage would not surpass 10% for the entire site and the loss of vegetation, under this alternative, would not occur within a stream or wetland buffer.

Trail construction would result in the loss of eight small trees within wet areas in the southern portion of the site. These trees would be hand cut to avoid further impacts. Finally, the parking area could be designed using gravel rather than asphalt, greatly reducing the amount of impervious cover introduced under this alternative. As a result, Alternative 3 would have a long-term, negligible, adverse impact on Chesapeake Bay Preservation Areas.

Cumulative Impacts

Past, present and reasonably foreseeable future actions have contributed cumulative impacts to Chesapeake Bay Preservation Areas in James City County. Present and on-going projects in the area that could contribute to these actions include long-term, minor, adverse impacts from the Jamestown Project and the Jamestown Settlement, long-term, negligible impacts from future development at Green Spring, as well as long-term, negligible to moderate, adverse impacts from ongoing land development throughout the region. The overall impact from these projects would be long-term, minor to moderate, and adverse. The No Action Alternative would not contribute to these impacts, and the action alternatives would contribute imperceptible increments to these long-term, minor to moderate, adverse cumulative impacts.

Conclusion

The No Action Alternative would have **no impact** on Chesapeake Bay Preservation Areas and would not contribute to long-term, minor to moderate, adverse cumulative impacts on these resources. The action alternatives would have a **long-term, negligible impact** on Chesapeake Bay Preservation Areas and would contribute imperceptible increments to long-term, minor to moderate, adverse cumulative impacts. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the park's establishing legislation, (2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents, there would be no impairment of park resources or values related to Chesapeake Bay Preservation Areas.

4.4 Cultural Resources

The CEQ regulations that implement NEPA require assessment of impacts to cultural as well as natural resources. In this Environmental Assessment/Assessment of Effect, impacts to cultural resources are described in terms of type, context, duration, and intensity, as described above, which is consistent with the regulations of the Council on Environmental Quality that implement NEPA. These impact analyses are intended, however, to comply with the requirements of both NEPA and Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended. In accordance with the regulations implementing

Section 106 and 110 of the NHPA (36 CFR Part 800, *Protection of Historic Properties*, and 36 CFR Part 800, respectively), impacts to archeological and cultural resources were identified and evaluated by (1) determining the area of potential effects; (2) identifying cultural resources present in the area of potential effects that were either listed on or eligible for listing on the National Register of Historic Places; (3) applying the criteria of adverse effect to affected cultural resources either listed on or eligible for listing on the National Register; and (4) considering ways to avoid, minimize, or mitigate adverse effects.

Under the regulations, a determination of either *adverse effect* or *no adverse effect* must also be made for affected, National Register eligible cultural resources. An *adverse effect* occurs whenever an impact alters, directly or indirectly, any characteristic of a cultural resource that qualifies it for inclusion in the National Register, e.g. diminishing the integrity of the resource's location, design, setting, materials, workmanship, feeling, or association. Adverse effects also include reasonably foreseeable effects caused by the preferred alternative that would occur later in time, be farther removed in the distance, or be cumulative (36 CFR Part 800.5, *Assessment of Adverse Effects*). A determination of *no adverse effect* means that there is an effect, but the effect would not diminish in any way the characteristics of the cultural resource that qualify it for inclusion in the National Register.

CEQ regulations and the NPS's *Conservation Planning, Environmental Impact Analysis, and Decision-making* (DO-12) also call for a discussion of the appropriateness of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact, e.g. reducing the intensity of an impact from major to moderate or minor. Any reduction in intensity of impact due to mitigation, however, is an estimate of the effectiveness of mitigation under NEPA only. It does not suggest that the level of effect as defined by Section 106 is similarly reduced. Although adverse effects under Section 106 may be mitigated, the effect remains adverse.

A Section 106 summary is included in the impact analysis sections for archeological and cultural resources under the NPS Preferred Alternative. The Section 106 summary is intended to meet the requirements of Section 106 and is an assessment of the effect of the undertaking (implementation of the alternative) on cultural resources, based upon the criterion of effect and criteria of adverse effect found in the Advisory Council's regulations.

4.4.1 Archeological Resources

Methodology

Certain important research questions about human history can only be answered by the actual physical material of cultural resources. Archeological resources have the potential to answer, in whole or in part, such research questions. An archeological site can be eligible to be listed in the National Register of Historic Places if the site has yielded, or may be likely to yield, information important in prehistory or history. An archeological site can be nominated to the National Register in one of three historic contexts or levels of significance: local, state, or national (NPS 1990). For purposes of analyzing impacts to archeological resources, thresholds of change for the intensity of an impact are based upon the potential of the site to yield information important in prehistory or history, as well as the probable historic context of the affected site:

Negligible: Impact is at the lowest levels of detection – barely measurable with no perceptible consequences, either adverse or beneficial, to archeological resources. For purposes of Section 106, the determination of effect would be *no adverse effect*.

Minor: Adverse Impact – Disturbance of a site(s) results in little, if any, loss of significance or integrity and the National Register eligibility of the site(s) is unaffected. For purposes of Section 106, the determination of effect would be *no adverse effect*.
Beneficial Impact – Maintenance and preservation of a site(s). For purposes of Section 106, the determination of effect would be *no adverse effect*.

Moderate: Adverse Impact – Disturbance of a site(s) does not diminish the significance or integrity of the site(s) to the extent that its National Register eligibility is jeopardized. For purposes of Section 106, the determination of effect would be *adverse effect*.
Beneficial Impact – Stabilization of a site(s). For purposes of Section 106, the determination of effect would be *no adverse effect*.

Major: Adverse Impact – Disturbance of a site(s) diminishes the significance and integrity of the site(s) to the extent that it is no longer eligible for listing on the National Register. For purposes of Section 106, the determination of effect would be *adverse effect*.
Beneficial Impact – Active intervention to preserve a site(s). For purposes of Section 106, the determination of effect would be *no adverse effect*.

Impacts of Alternative 1 (No Action)

Under the No Action Alternative, there would be no change in management action. Archeological research would continue to occur on site. There would be no project-related ground disturbance that would result in impacts to archeological resources. These activities, coupled with occasional tours, would lead to increased erosion of the site over time. The overall impact would be long-term, minor, and beneficial.

Impacts of Alternative 2 (NPS Preferred Alternative)

Under Alternative 2, more resources would be available for enhanced protection, preservation, and maintenance, as well as a better understanding and interpretation of 17th and 18th century resources. Overall, the findings of the Phase II archeological investigation that analyzed the proposed project area demonstrated that no relevant cultural materials exist in the project area that could prevent construction of the visitor contact station. Additional studies would be carried out to determine if the two resources found within the original access road swath were NR eligible features.

Despite the construction of an archeological station on site, archeological resources and museum objects would continue to be transported off site for curation. This would allow for a more focused investigation as well as better security for these resources.

The Phase II archeological investigation of Green Spring focused on the area that would be used to develop the access road, parking area, and facilities. Further Phase II archeological studies would be required in a heavily forested area near the buildings and in the trail swath. However, developing visitor facilities, trail, and interpretive stations could have a potential minor adverse impact on archeological resources.

Utility lines would follow the proposed access road. The access road's development swath has been designed to avoid any impacts to archeological resources. An archeologist would be required on site during all construction activities to ensure known archeological resources were avoided and to assess any unknown resources that may be uncovered. Colonial NHP would continue to coordinate with the SHPO as the project developed and would be prepared to enter into a Memorandum of Agreement (MOA) and/or a Programmatic Agreement (PA) if the SHPO deemed it necessary. The overall impact would be short- and long-term, minor, and adverse.

Section 106 Summary

After applying the Advisory Council on Historic Preservation's criteria of adverse effects (36 CFR Part 800.5, *Assessment of Adverse Effects*), the National Park Service concludes that implementation of the NPS Preferred Alternative would have *no adverse effect* on the archeological resources of Colonial NHP.

Impacts of Alternative 3

As in Alternative 2, the NPS Preferred Alternative, more resources would be available for better protection, preservation, and maintenance, as well as better understanding and interpretation of 17th and 18th century colonial resources. Additional studies would be carried out to determine if the two resources found within the original access road swath were NR eligible features.

Despite the construction of an archeological station on site, archeological resources and museum objects would continue to be transported off site for curation. This would allow for a more focused investigation as well as better security for these resources.

Although the area of impact for this alternative would be smaller than that in Alternative 2, previous Phase II archeological investigations focused on the proposed area of impact for Alternative 2. Therefore new investigations would be necessary to identify any potential resources in the Alternative 3 project area. The area of this study would be smaller as the site is located adjacent to the main road and electric lines, the only utility required for the site. The overall impact would be short- and long-term, minor, and adverse.

Section 106 Summary

After applying the criteria of adverse effects (36 CFR Part 800.5, *Assessment of Adverse Effects*), the National Park Service concludes that implementation of Alternative 3 would have *no adverse effect* on the archeological resources of Colonial NHP.

Cumulative Impacts

Past, present and reasonably foreseeable future actions have contributed impacts to archeological resources at Green Spring. These projects include actions occurring before the establishment of the park and/or as a result of inadvertent impacts prior to the legal requirements for archeological survey, site protection, and mitigation. Present and on-going projects in the area that could contribute to these actions include short- and long-term, minor to moderate, adverse impacts from the Jamestown Project and the Jamestown Settlement, as well as short- and long-term, minor, adverse impacts from future development at Green Spring. The overall impact from these projects is long-term, minor to moderate, and adverse. All of the alternatives presented above would contribute noticeable increments to long-term, minor to moderate, adverse cumulative impacts.

Conclusion

The No Action alternative would have a **long-term, minor, beneficial impact** on archeological resources. The action alternatives would have a **long-term, minor, adverse impact** on archeological resources. All of these alternatives would contribute noticeable increments to long-term, minor to moderate, adverse cumulative impacts. It is not anticipated that implementing either of these alternatives would have major adverse impacts to resources or values whose conservation are (1) necessary to fulfill specific purposes identified in the park's establishing legislation, (2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents, there would be no impairment of park resources or values related to archeological resources.

4.4.2 Historic Structures

Methodology

In order for a structure or building to be listed on the National Register of Historic Places, it must be associated with an important historic context, i.e. possess significance – the meaning or value ascribed to the structure or building, *and* have integrity of those features necessary to convey its significance, i.e. location, design, setting, workmanship, materials, feeling, and association (NPS 1990). For purposes of analyzing potential impacts to historic structures/buildings, the thresholds of change for the intensity of an impact are defined as follows:

Negligible: Impact(s) is at the lowest levels of detection – barely perceptible and not measurable. For purposes of Section 106, the determination of effect would be *no adverse effect*.

Minor: Adverse Impact – Impact would not affect the character defining features of a National Register of Historic Places eligible or listed structure or building. For purposes of Section 106, the determination of effect would be *no adverse effect*.
Beneficial Impact – Stabilization/preservation of character defining features in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*. For purposes of Section 106, the determination of effect would be *no adverse effect*.

- Moderate: Adverse Impact – Impact would alter a character defining feature(s) of the structure or building but would not diminish the integrity of the resource to the extent that its National Register eligibility is jeopardized. For purposes of Section 106, the determination of effect would be *no adverse effect*.
Beneficial Impact – Rehabilitation of a structure or building in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*. For purposes of Section 106, the determination of effect would be *no adverse effect*.
- Major: Adverse Impact – Impact would alter a character defining feature(s) of the structure or building, diminishing the integrity of the resource to the extent that it is no longer eligible to be listed in the National Register. For purposes of Section 106, the determination of effect would be *adverse effect*.
Beneficial Impact – Restoration of a structure or building in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*. For purposes of Section 106, the determination of effect would be *no adverse effect*.

Impacts of Alternative 1 (No Action)

Under the No Action Alternative, Colonial NHP would continue its effort to preserve historic structures within its boundaries. This includes the three remaining above ground architectural features, the “jail,” the orangery wall, and spring house, as well as the ditches and terraces that run throughout the unit. The overall impact under this alternative would be long-term, minor, and beneficial.

Impacts of Alternative 2 (NPS Preferred Alternative)

Under Alternative 2, the “jail” and spring house would be cleaned and stabilized in addition to routine maintenance. The orangery wall will be stabilized and preserved. The proposed trail would utilize an existing road bed to avoid impacts to ditches or terraces whenever possible. Where use of the road bed is not possible, the trail would be developed with fill methods, rather than cutting into existing features. The overall impact would be long-term, minor, and beneficial.

Section 106 Summary

After applying the criteria of adverse effects (36 CFR Part 800.5, *Assessment of Adverse Effects*), the NPS concludes that implementation of the NPS Preferred Alternative would have *no adverse effect* on the historic structures of Colonial NHP.

Impacts of Alternative 3

Alternative 3 would have the same impacts on historic structures as those described in Alternative 2.

Section 106 Summary

After applying the criteria of adverse effects (36 CFR Part 800.5, *Assessment of Adverse Effects*), the NPS concludes that implementation of Alternative 3 would have *no adverse effect* on the historic structures of Colonial NHP.

Cumulative Impacts

Present and reasonably foreseeable future actions that have and could continue to contribute cumulative impacts to historic structures within the park include long-term, negligible to moderate, adverse effects from the Jamestown Project and the work at Jamestown Settlement, as well as long-term, minor, beneficial impacts from future development at Green Spring. Actions at Jamestown could alter the use and/or significance of historic structures. Historic structures at Green Spring, however, would continue to be preserved and could be more thoroughly interpreted. The overall impact of these projects would be long-term, minor to moderate, and adverse. The alternatives presented above would improve these conditions by contributing noticeable beneficial increments to otherwise long-term, minor to moderate, adverse cumulative impacts.

Conclusion

Implementation of any of the three alternatives described above would have a **long-term, minor beneficial impact** to historic structures at the site and would contribute noticeable increments to long-term, minor to moderate, adverse cumulative impacts. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the park's establishing legislation, (2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents, there would be no impairment of park resources or values related to historic structures.

4.4.3 Cultural Landscapes

Methodology

Cultural landscapes are the result of the long interaction between people and the land, the influence of human beliefs and actions over time upon the natural landscape. Shaped through time by historical land-use and management practices, as well as politics and property laws, levels of technology, and economic conditions, cultural landscapes provide a living record of an area's past, a visual chronicle of its history. The dynamic nature of modern human life, however, contributes to the continual reshaping of cultural landscapes; making them a good source of information about specific times and places, but at the same time rendering their long-term preservation a challenge.

In order for a cultural landscape to be listed on the National Register, it must possess significance (the meaning or value ascribed to the landscape) *and* have integrity of those features necessary to convey its significance. The character defining features of a cultural landscape include spatial organization and land patterns; topography; vegetation; circulation patterns; water features; and structures/buildings, site furnishings and objects (see NPS 1996). For purposes of analyzing potential impacts to cultural landscapes, the thresholds of change for the intensity of an impact are defined as follows:

- Negligible: Impact(s) is at the lowest levels of detection – barely perceptible and not measurable. For purposes of Section 106, the determination of effect would be *no adverse effect*.
- Minor: Adverse Impact – Impact would not affect the character defining patterns or features of a National Register of Historic Places eligible or listed cultural landscape. For purposes of Section 106, the determination of effect would be *no adverse effect*.
Beneficial Impact – Preservation of character defining features in accordance with the *Secretary of the Interior’s Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes*. For purposes of Section 106, the determination of effect would be *no adverse effect*.
- Moderate: Adverse Impact – Impact would alter a character defining pattern(s) or feature(s) of the cultural landscape but would not diminish the integrity of the landscape to the extent that its National Register eligibility is jeopardized. For purposes of Section 106, the determination of effect would be *no adverse effect*.
Beneficial Impact – Rehabilitation of a landscape or its patterns and features in accordance with the *Secretary of the Interior’s Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes*. For purposes of Section 106, the determination of effect would be *no adverse effect*.
- Major: Adverse Impact – Impact would alter a character defining pattern(s) or feature(s) of the cultural landscape, diminishing the integrity of the resource to the extent that it is no longer eligible to be listed in the National Register. For purposes of Section 106, the determination of effect would be *adverse effect*.
Beneficial Impact – Restoration of a landscape or its patterns and features in accordance with the *Secretary of the Interior’s Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes*. For purposes of Section 106, the determination of effect would be *no adverse effect*.

Impacts of Alternative 1 (No Action)

Under the No Action Alternative, existing landscape features would be preserved in their current configuration, meaning that non-historic intrusions would continue to dominate the setting. Furthermore, features significant to the organization and development of the colonial plantation may be obscured by encroaching vegetation. Historic vistas and related cultural resources on adjacent lands would continue to be lost to development. The overall impact to cultural landscapes would be long-term, minor to moderate, and adverse.

Impacts of Alternative 2 (NPS Preferred Alternative)

Under the Preferred Alternative, the existing ‘modern’ spatial patterns and the character defining landscape features from all time periods would remain and be interpreted for visitors. The new building complex, parking lot and trail would be hidden from the site by the 100-foot evergreen buffer. The new addition of an entry road would bisect the upper field, but would not be seen from the historic core area

due to the drop in elevation by the terraces. The alignment of the trail (Figure 3) will follow the existing road traces and topography that would allow a minimum cut, maximum of fill to be applied to make the trail ADA accessible and meet the interpretive goals for the site. Low profile interpretive waysides would be located adjacent to the trail. In light of the new discoveries of outbuildings and garden walls in the lower terrace, near the springhouse, the trail would lead the visitor to a point where they can view the entire area and understand how the garden wall and out buildings interconnected. Selective removal and limbing of the young trees will allow this visual connection.

The remaining existing ditches, terraces and mature trees throughout the site would be maintained and preserved, since the site is now open to the public. Landscape features currently under forest cover would remain protected since there are no plans for trails. The overall impact to the cultural landscape would be long-term, minor to moderate, and beneficial.

Section 106 Summary

After applying the criteria of adverse effects (36 CFR Part 800.5, *Assessment of Adverse Effects*), the National Park Service concludes that implementation of the NPS Preferred Alternative would have *no adverse effect* on the cultural landscapes of Colonial NHP.

Impacts of Alternative 3

As in Alternative 2, the existing ‘modern’ spatial patterns and the character defining landscape features from all time periods would remain and be interpreted for visitors. However, the location of new interpretive facilities would be more visible than in the Preferred Alternative and would encroach on the historic scene. The single row of red cedars provides only about a 20-foot buffer. The entry drive, however, would not be seen from the historic core, since its horizontal alignment is most easily hidden by the tree line. The pedestrian trail would extend along the edge of the large wooded area, which is generally flat. It would incorporate the same installation treatment of minimum cut, maximum fill to minimize any archeological impacts and follow the current topography, existing road and road trace alignment. The location of the waysides and the trail ending near, but not at, the springhouse is the same as in Alternative 2. The remaining existing ditches, terraces and mature trees throughout the site would be maintained and preserved, since the site is now open to the public. Landscape features currently under forest cover would remain protected since there are no plans for trails. The overall impact of on cultural landscapes would be long-term, minor, and beneficial.

Section 106 Summary

After applying the criteria of adverse effects (36 CFR Part 800.5, *Assessment of Adverse Effects*), the National Park Service concludes that implementation of the Alternative 3 would have *no adverse effect* on the cultural landscapes of Colonial NHP.

Cumulative Impacts

Present and reasonably foreseeable future actions that have and could continue to contribute cumulative impacts to historic structures within the park include long-term, negligible to moderate, adverse impacts from the Jamestown Project and the work at Jamestown Settlement, as well as long-term, minor, beneficial impacts from future development at Green Spring. The overall impact of these projects would

be long-term, minor to moderate, and adverse. The No Action Alternative and the NPS Preferred Alternative would contribute appreciable increments to these impacts. Alternative 3 would contribute noticeable increments to these long-term, minor to moderate, adverse cumulative impacts.

Conclusion

The No Action Alternative would result in long-term, minor to moderate, adverse impacts to cultural landscapes and would contribute appreciable increments to cumulative impacts. The NPS Preferred Alternative would result in long-term, minor to moderate, beneficial impacts and contribute appreciable increments to long-term, minor to moderate, adverse cumulative impacts. Finally, Alternative 3 would have long-term, minor, beneficial impacts on the cultural landscape and contribute noticeable increments to cumulative impacts. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the park's establishing legislation, (2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents, there would be no impairment of park resources or values related to cultural landscapes.

4.5 Visual Resources

4.5.1 Methodology

The existing visual environment is defined as what is seen by the visitor during the approach to Green Spring, as well as what is seen by the visitor within the area itself. The visual environment affects both the anticipation and experience at Green Spring. The quality of the visual environment is a vital resource and is instrumental in setting the stage for the Green Spring experience and its history.

All available information on viewsheds potentially impacted in various areas of the park was compiled for this document. Where possible, map locations of important areas were compared with locations of proposed developments and modifications of existing facilities. Predictions about short- and long-term site impacts were based on previous projects with similar results. The thresholds of change for the intensity of an impact are defined as follows:

- Negligible: The visual quality of the landscape would not be affected or the impacts would be at or below the level of detection, and the changes would be so slight that they would not be of any measurable or perceptible consequence to the visitor experience.
- Minor: Impacts to the visual quality of the landscape would be detectable, although the impacts would be localized and would be small and of little consequence to the visitor experience. Mitigation measures, if needed to offset adverse impacts, would be simple and successful.
- Moderate: Impacts to the visual quality of the landscape would be readily detectable and localized, with consequences at the regional level. Mitigation measures, if needed to offset adverse impacts, would be extensive and likely successful.

Major: Impacts to the visual quality of the landscape would be obvious and would have substantial consequences to the visitor experience in the region. Extensive mitigation measures would be needed to offset any adverse impacts, and their success would not be guaranteed.

4.5.2 Impacts of Alternative 1 (No Action)

No physical changes would be made to the site that would affect the visual experience. The rural character of the site would be retained, and views of the site from Route 614 would be unchanged. Over time, vegetation could overtake the site and threaten both historic and modern viewsheds. Overall, this alternative would have a long-term, minor, adverse impact to visual resources.

4.5.3 Impacts of Alternative 2 (NPS Preferred Alternative)

Under Alternative 2, a new visitor contact complex would be constructed; however, because it would be built within a wooded area and screened by a 100-foot vegetative buffer, the complex would be hidden and the rural character of the site would be preserved. The access road, trail, signs, and benches would slightly impose on the existing configuration of open fields and woods. Visitors traveling along Route 614 would only see the entrance driveway and some new signage. The impact of Alternative 2 on visual resources would be long-term, minor, and adverse.

4.5.4 Impacts of Alternative 3

In Alternative 3, a smaller visitor contact facility would be constructed. The facility would be screened from the north and south by a wooded area and a row of cedar trees, respectively. By placing the facility in this location, the rural appearance of the site would be maintained; however, the facility would be more visible than in Alternative 2, the NPS Preferred Alternative. The trail, signs, and benches would slightly impose on the existing configuration of open fields. As a result, the impact to visual resources would be long-term, minor, and adverse.

4.5.5 Cumulative Impacts

As development around the park increases, the visual quality and visitor experience would generally decrease. Present and reasonably foreseeable future actions that would have an impact on visual resources within the unit include a potential long-term moderate, adverse impacts from continued residential development around the unit; long-term, minor, adverse impacts from the James City County Greenway Master Plan, long-term, negligible to major, adverse and beneficial impacts from the Jamestown Project, as well as long-term, minor, adverse impacts from future work at Green Spring. The major impacts from the Jamestown Project have already been addressed in the *Jamestown Project Final Development Concept Plan/Environmental Impact Statement* (NPS 2003c). The impacts from the proposed project would not increase these major impacts. The continued residential development in the area would infringe upon the natural and historical nature of the area. The Greenway master plan could open up vistas that protect critical viewsheds. The Jamestown Project would focus on developing historically significant viewsheds, possibly at the expense of other potential vistas, while the future development at Green Spring

could add further development to the relatively rural character of the site. The overall impact from these cumulative projects would be long-term, minor to major, adverse and beneficial. The alternatives presented above would contribute noticeable increments to these long-term, minor to major, adverse and beneficial cumulative impacts.

4.5.6 Conclusion

The overall impact to visual resources under all of the alternatives presented above would be **long-term, minor, and adverse**. These alternatives would contribute noticeable increments to long-term, minor to major, adverse and beneficial cumulative impacts. The preferred alternative would have minor overall impact to visual resources and would contribute minor increments to cumulative impacts. The major impacts from the Jamestown Project have already been addressed in the *Jamestown Project* (NPS 2003c). The impacts from this proposed project would not increase these major impacts. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the park's establishing legislation, (2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents, there would be no impairment of park resources or values related to visual resources.

4.6 Lightscapes

4.6.1 Methodology

The NPS *Interim Technical Guidance on Assessing Impacts and Impairment to Natural Resources* (NPS 2003b) defines lightscapes as, "a term encompassing the dark night sky, the experience of darkness, and the ecological importance of natural light cycles." The NPS recognizes the importance of protecting natural lightscapes not only for visitor experience, but also for protection of ecological integrity.

The Clean Air Act also seeks to protect natural lightscapes by empowering NPS superintendents with the responsibility to protect visibility and all other air quality values from adverse impacts. Light pollution, like air pollution, is a trans-boundary process. Maintaining the primeval character of the wilderness is challenged by the constant visual impact of light pollution. Therefore, proposed projects that create light pollution in quantities that may affect the natural condition of wilderness areas within Colonial NHP would likely be considered impairment. Because of the radius of impact that outdoor lighting may have, projects outside of a wilderness area may still directly impact designated wilderness lands and therefore should be appropriately analyzed in accordance with wilderness guidelines (NPS 2000). Based on these findings, the following intensity levels were developed:

- Negligible:** Illumination levels are below what would alter biological processes or behavior. Historic objects, cultural landscapes, wilderness areas, and other unique resources are framed against a natural lightscape with pristine and timeless qualities.
- Minor:** Illumination levels may be within the detectability of numerous species, but fundamental biological processes such as navigation, cover, and photosynthesis are unfiltered. Artificial lights may be noticed, but are quickly forgotten and do not affect the experience of a historic or cultural landscape, wilderness area, or other resources unique to a particular park. All visible lights are shielded or produce no glare to the observer, allowing full use of night vision.
- Moderate:** Illumination levels are detectable by numerous species, and biological processes are suspected of being altered. Artificial lights are frequently noticed and continue to intrude into the experience of other resources. The human eye never fully adapts to darkness due to ambient illumination or glare. Outdoor light fixtures are unshielded, too bright, or otherwise produce glare.
- Major:** Illumination levels are high enough to affect a range of species, resulting in suspected or documented stress and ecological disruption. Artificial lights are frequently noticed and continue to intrude into the experience of other resources. Numerous unshielded lights are visible, even at a distance, and produce enough glare that the human eye never fully adapts.

4.6.2 Impacts of Alternative 1 (No Action)

Under the No Action Alternative, no changes would be made to the site to introduce new lights. Traffic along Centerville Road would continue to provide periodic disturbances. Additionally, light pollution from the surrounding residential/commercial development would detract from the natural darkness of the site. The overall impact would be long-term, minor, and adverse.

4.6.3 Impacts of Alternative 2 (NPS Preferred Alternative)

Under the NPS Preferred Alternative, flood lights equipped with motion sensors would be installed outside the new buildings. Because the site would close by sundown, there would be no lights required to support visitor use. Because the project site would be screened from the rest of the site, only a small area would be impacted by these lights. The majority of Green Spring would remain at current light pollution levels. The overall impact would be long-term, minor, and adverse.

4.6.4 Impacts of Alternative 3

Under Alternative 3, flood lights equipped with motion sensors would be installed outside the new building. Because the site would close at sundown, there would be no lights required to support visitor use. The project area is located adjacent to Centerville Road. The periodic illumination from the floodlights would in many ways mimic the lights from passing cars. These lights would also be screened

from the site by a row of cedars. As a result, the majority of Green Spring would remain at current light pollution levels. The overall impact would be long-term, minor, and adverse.

4.6.5 Cumulative Impacts

Present or reasonably foreseeable future actions that would have an impact on visitor use and experience within the park and region include long-term, minor to moderate, adverse impacts from future developments at Green Spring. These developments would include moving current facilities or developing new facilities that would require at least the same lighting proposed in this project. Future developments may also include the closing of Centerville Road to regular traffic, which would greatly reduce periodic light pollution. The alternatives presented above would contribute noticeable increments to these long-term, minor to moderate, adverse cumulative impacts.

4.6.6 Conclusion

The overall impact to lightscapes under all the alternatives presented above would be **long-term minor, and adverse** and would contribute noticeable increments to long-term, minor to moderate, adverse cumulative impacts on lightscapes in the area. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the park's establishing legislation, (2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents, there would be no impairment of park resources or values related to lightscapes.

4.7 Visitor Use and Experience

4.7.1 Methodology

NPS Management Policies 2001 (NPS 2000) state that the enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks and that the NPS is committed to providing appropriate, high-quality opportunities for visitors to enjoy the parks.

Past interpretive and administrative planning documents provided background on changes to the visitor experience over time. Anticipated impacts on the visitor experience were analyzed using information from the Colonial NHP's 1999 Long-Range Interpretive Plan for Yorktown and draft 1997-1998 Jamestown Master Plan, as well as the Virginia Tourism Corporation's 1997 Virginia Visitor Survey. The Long-Range Interpretive Plan describes the results of a park visitor use survey from 1987, characterizing visitor type and use patterns for Jamestown and Yorktown. The 1997 Virginia Visitor Survey looked at recent visitor use patterns and preferences as well as visitor profiles for major regional attractions, such as Colonial Williamsburg, the Jamestown Settlement, and the Yorktown Victory Center. The 1997 Jamestown Master Plan predicted the type of visitor experiences available to potential visitors to Jamestown for the year 2007 and beyond, based on planned future facilities expansion and interpretive program developments.

Field visits to area attractions offering interpretive experiences in colonial history were conducted to identify existing interpretive efforts, themes, and audiences that may relate to Green Spring; the field visits included consultations with staff of state parks and private organizations that manage sites. Brochures and Internet materials were also reviewed. Additional information on Green Spring's potential to offer visitors educational opportunities was gathered during consultations with park staff, interested members of the public, local educators, and subject-matter experts. The effectiveness of interpretive opportunities and the potential consequences for Green Spring visitors were assessed based on the experience of interpretive rangers and other staff.

There is no pre-existing visitation base for Green Spring, since it has been closed to the public since its acquisition by the NPS. It is also difficult to predict the level of interest in the site because this depends heavily on the creativity of on-site interpretive programming, as well as the opportunity for programming to fill an unused interpretive niche. Therefore, in order to assess potential visitor use, Colonial NHP provided base visitor use data derived from annual visitation counts during the past twenty years. This information was combined with population data for James City County, traffic volume data for local roads around Green Spring, and visitor use at Green Spring. Other NPS units and non-NPS attractions comparable in size, potential facilities development, and types of interpretive programs and themes were also considered. Based on these findings, the following intensity levels were developed:

- Negligible: Visitors would not be affected, or changes in visitor use and/or experience would be below or at the level of detection. The visitor would not likely be aware of the impacts associated with the alternative.
- Minor: Changes in visitor use and/or experience would be detectable, although the changes would be slight. The visitor would be slightly aware of the impacts associated with the alternative.
- Moderate: Changes in visitor use and/or experience would be readily apparent. The visitor would be aware of the impacts associated with the alternative and would likely be able to express an opinion about the changes.
- Major: Changes in visitor use and/or experience would be readily apparent and would be severely adverse or exceptionally beneficial. The visitor would be aware of the impacts associated with the alternative and would likely express a strong opinion about the changes.

4.7.2 Impacts of Alternative 1 (No Action)

Under Alternative 1, there would be no visitor experience at the site. Special permission for site visits would be required by researchers, and infrequent tours or other public events could occur. No programming or facilities development would occur at Green Spring, and the unit's interpretive potential for describing the mid- to late 17th century Tidewater experience would remain largely untapped, as few area historic sites address this period.

Visitors would continue to benefit from existing information and interpretive programming on Green Spring at the Jamestown Visitor Center and through the Internet; however, Green Spring-related

programming and exhibits would be limited to a small percentage of the visitor population. Little if any connection would be able to be made between Historic *Jamestowne* and Green Spring. Therefore, Colonial NHP would be limited in its ability to tell the story of inland colonization and plantation development in the Virginia colony. Furthermore, the educational experience would be unable to develop to connect to other well known historical events, such as Bacon's Rebellion. The No Action Alternative would have a long-term, moderate, adverse impact to visitor use and experience.

4.7.3 Impacts of Alternative 2 (NPS Preferred Alternative)

New visitors would be attracted to Green Spring, likely from the existing visitor pool at Jamestown Island and Jamestown Settlement. Visitation would probably be seasonal, excluding the winter and early spring, and would be limited because of park and volunteer staffing constraints. Limited opportunities to target newer, less traditional park audiences would have a minor but beneficial impact on the diversity of the visitor base.

Based on NPS estimates, by the 400th anniversary of the founding of Jamestown in 2007, annual visitor numbers could reach 160,000 (at least 60,000), and range anywhere from 85,000 – 130,000 in the years that follow. The majority of these visitors, 55-60%, would be drawn from the Jamestown Island visitor pool, as part of combined promotion and interpretive efforts. Additional visitors, 15-30%, would be drawn from the Jamestown Settlement. In general, visitors to Jamestown Settlement are looking for more “hands-on” interpretation. The archeology station that would exist under this alternative could provide this type of interactive experience. The natural setting of Green Spring would serve as an important element to draw visitors from both of these groups to the site. Additional visitors could be drawn from the local community. Surveys have shown that residents of James City and York counties have a vested interest in the natural and cultural history of the region. Green Spring not only supports these interests, but also has the support of a strong friends group. Based on this level of interest and support, the Green Spring site proposed under this alternative could draw 7-16% of the annual visitors from the local community. Finally, a small portion of the visitors could be defined as “accidental.” These visitors would be those that drive by the site and decide to stop and explore.

In addition, Green Spring's visitor information and orientation would be improved and expanded. Visitors would not only understand Governor William Berkeley's life and legacy but would gain a greater understanding of how developments at Green Spring influenced many aspects of American law, society, and economy. Visitors would experience aspects of early colonial history that are not interpreted at other NPS and non-NPS sites in the region. In addition, visitors would gain a better understanding of the relationships among park units and resources.

A formalized trail would be universally accessible and would connect the new interpretive/visitor service area with the core archeological area. The trail would allow visitors to access and see the resources. Improvements and/or the possible closure of Centerville road discussed in *Green Spring Final General Management Plan Amendment/Abbreviated Final Environmental Impact Statement* could occur in future developments (See Section 1.2.3). Overall, Alternative 2 would have a long-term, moderate, beneficial impact on visitor use and experience.

4.7.4 Impacts of Alternative 3

Benefits would be similar to those in Alternative 2; however, elderly and disabled visitors, who were included in project scoping efforts, believe that the location of this alternative would create a longer and more difficult walk to reach the archeological and historical resources.

Based on NPS estimates, annual visitor numbers could reach 70,000 by 2007 (at least 20,000) and range from 35,000 to 55,000 in the years that follow. A majority of these visitors, 55-75%, would be drawn from the Jamestown Island visitor pool. These visitors would be attracted by the joint promotion of the two sites, as well as the efforts made to interpret Green Spring at Jamestown. Because the Green Spring site would be less visitor friendly than in the NPS Preferred Alternative, Colonial NHP would be forced to rely more heavily on the NPS visitor pool to attract people to the site. Additional visitors could be drawn from the Jamestown Settlement site. An estimated 15-40% of Green Spring's potential visitors could originate from the settlement. This smaller percentage is attributed to variations in visitor interests. Visitors to the settlement tend to be more interested in "hands-on interpretation." The site proposed under this alternative would offer less visitor services, and therefore be less attractive to those visitors looking for a more interactive experience. Local residents are also expected to visit the site. The NPS estimates that 10-15% of the site's annual visitation could be comprised of local residents. A final group of visitors are defined as "accidental." These visitors would be comprised of those who drive by the site and decide to stop and explore. The group would probably average less than 1% of the total visitorship of the site.

In addition, there would be no water service under Alternative 3, and instead chemical toilets would be provided. Compared to Alternative 2, this alternative would offer a smaller visitor contact area and reduced visitor services (chemical toilets). The majority of the background information on the site would be provided at Jamestown. As a result, the overall impact to visitor use and experience would be long-term, minor, and beneficial.

4.7.5 Cumulative Impacts

Present or reasonably foreseeable future actions that would have an impact on visitor use and experience within the park and region include long-term, minor to moderate, beneficial impacts from the James City County Greenway Master Plan and the Colonial NHP ATS; long-term, minor to moderate, beneficial impacts from future development at Green Spring; as well as long-term, major, beneficial impacts from the Jamestown Project and the work at Jamestown Settlement. These major impacts have already been addressed in the *Jamestown Project Final Development Concept Plan/Environmental Impact Statement* (NPS 2003c), and the proposed project would not add to these major impacts. The Jamestown Project and Jamestown Settlement work would seek to enhance the overall visitor experience to these sites and the region. The Greenway Master Plan and the Colonial NHP ATS would provide enhanced transportation and access opportunities to the site that would also allow for improved education and interpretation. The overall impact from these actions would be long-term, minor to major, and beneficial.

4.7.6 Conclusion

The overall impact to visitor use and experience under the No Action Alternative would be **long-term negligible, and adverse** and would contribute imperceptible increments to long-term, minor to major, beneficial cumulative impacts on visitor use and experience in the area. Alternative 2 would have a **long-term, moderate, beneficial** impact on visitor use and experience and Alternative 2 would contribute appreciable increments to long-term, minor to major, beneficial cumulative impacts. Alternative 3 would have a **long-term, minor, beneficial** impact on visitor use and experience and Alternative 3 would contribute noticeable increments to long-term, minor to major, beneficial cumulative impacts to visitor use and experience in the area. These major impacts have already been addressed by the *Jamestown Project Final Development Concept Plan/Environmental Impact Statement* (NPS 2003c), and the impacts of the proposed project would not add to these major impacts. Therefore, because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the park's establishing legislation, (2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents, there would be no impairment of park resources or values related to visitor use and experience.

4.8 Circulation and Site Access

4.8.1 Methodology

The purpose of park trails is to enhance visitor experience while providing safe and efficient circulation and access to park resources. Circulation is also dependent on site access via entry roads and regional roadways. The thresholds of change for the intensity of an impact are as follows:

- | | |
|-------------|--|
| Negligible: | Circulation and site access would not be affected, or the impacts would be at the lowest levels of detection and would not have an appreciable impact on pedestrian and vehicular traffic flow. There would be no changes in the site accessibility. |
| Minor: | The impact would be detectable but would be of a magnitude that would not have an appreciable impact on pedestrian and vehicular traffic flow. There would be no noticeable changes in the circulation patterns or site accessibility. If mitigation was needed to offset adverse impacts, it would be simple and likely successful. |
| Moderate: | The impacts would be readily apparent and would result in a substantial change in circulation patterns, congestion, and/or site accessibility in a manner noticeable to the public. Mitigation would be necessary to offset adverse impacts and would likely be successful. |
| Major: | The impacts would be readily apparent and would result in a substantial change in circulation in a manner noticeable to the public and be markedly different from the present circulation patterns and site accessibility. Mitigation measures to offset adverse impacts would be needed, would be extensive, and their success would not be guaranteed. |

4.8.2 Impacts of Alternative 1 (No Action)

Public roads and intersections adjacent to the park would remain available to traffic generated by surrounding modern development, and the Park would take no action that would affect motor vehicle access to the site or impact local roads. Development pressures to widen roads around Green Spring would continue, which could result in the eventual loss of critical associated scenic and cultural resources. No formalized trails would be developed under this project, however, coordination with VDOT and James City County to develop a regional trail system would continue. Therefore, there would be no change to the current circulation or site access patterns. The overall impact to circulation and site access would be long-term, negligible, and adverse.

4.8.3 Impacts of Alternative 2 (NPS Preferred Alternative)

Access to the site would be carefully managed and controlled. The NPS would continue to follow its commitment to work with VDOT on reducing vehicular speeds and potential traffic calming measures around Green Spring. While these measures would work to enhance vehicular safety in and around the site, the current site distances already comply with standards set by the American Association of State Highway Transportation Officials (AASHTO). Pedestrian access along Centerville Road would not be enhanced under this alternative. However, a bicycle rack would be installed near the visitor contact facilities to accommodate cyclists that stop to walk around the site.

While the site is open, visitor access would take place through self-guided walking tours or guided ranger tours, or for special events and programs focusing specifically on archeology. Visitors would be permitted to walk unescorted only where paths are located. The site entry from Route 614 would be gated at the end of each day.

Special design considerations for trails would direct visitors away from sensitive resources. An accessible, low impact trail constructed of Klingstone or compacted gravel, both universally accessible materials, would lay lightly on the landscape, and would not compete with the natural setting. The overall impact to circulation and site access would be long-term, moderate, and beneficial.

4.8.4 Impacts of Alternative 3

Access to the site would be carefully managed and controlled. The NPS would continue to follow its commitment to work with VDOT on reducing vehicular speeds and potential traffic calming measures around Green Spring. While these measures would work to enhance vehicular safety in and around the site, the current site distances already comply with standards set by AASHTO. Pedestrian access along Centerville Road would not be enhanced under this alternative. However, a bicycle rack would be installed near the visitor contact facility to accommodate cyclists that stop at the site.

While the site is open, visitor access would take place through self-guided walking tours or guided ranger tours, or for special events and programs focusing specifically on archeology. Visitors would be permitted

to walk unescorted only where paths are located. The site entry from Route 614 would be gated at the end of each day.

Trails would be constructed of a Klingstone or compacted gravel, both universally accessible materials, and would be designed to direct visitors around sensitive resources. The distance from the visitor contact facility and parking to the historic core area would be somewhat greater than in Alternative 2, the NPS Preferred Alternative. According to comments made during the scoping process, this distance would make access for visitors with disabilities or elderly visitors much more difficult. The overall impact of Alternative 3 on circulation and site access would be long-term, minor, and beneficial.

4.8.5 Cumulative Impacts

Present or reasonably foreseeable future actions that would have an impact on circulation and site access to and within the unit include long-term, minor to moderate beneficial, impacts from the James City County Greenway Master Plan and the Colonial NHP ATS; long-term, minor to moderate, beneficial impacts from future developments at Green Spring; as well as long-term, minor to moderate, beneficial impacts from the Jamestown Project and work at the Jamestown Settlement. The Greenway project, a collaborative effort by the County and VDOT with input from the NPS, could create bicycle/pedestrian paths leading to the Green Spring area. This would provide a means to reach the site without relying on automobile or other vehicle. The ATS would also provide an enhanced means of reaching the site from other units of Colonial NHP. This would not only facilitate access, but enhance the park's ability to educate visitors about the site. Further development at Green Spring could enhance vehicular safety around the site and improve pedestrian circulation within the site. Finally, the Jamestown Project and work at the Jamestown Settlement would offer improved site access and circulation throughout the region. The overall impact from these projects would be long-term, minor to moderate, and beneficial. The No Action Alternative would contribute imperceptible increments to these impacts. Alternative 2 would contribute appreciable increments to these cumulative impacts. And, Alternative 3 would contribute noticeable increments to these long-term, minor to moderate, beneficial cumulative impacts.

4.8.6 Conclusion

The overall impact to circulation under the No Action Alternative would be **long-term, negligible, and adverse**. The No Action Alternative would contribute imperceptible increments to long-term, minor to moderate, beneficial cumulative impacts to circulation. Alternative 2, however, would have a **long-term, moderate, beneficial** impact on circulation and site access. It would contribute appreciable increments to long-term, minor to moderate, beneficial cumulative impacts on circulation and site access. Finally, Alternative C would have a **long-term, minor, beneficial impact**; and contribute noticeable increments to long-term, minor to moderate, beneficial cumulative impacts. Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the park's establishing legislation, (2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents, there would be no impairment of park resources or values related to site access and circulation.

4.9 Park Operations, Infrastructure, and Community Services

4.9.1 Methodology

Park operations, for the purpose of this analysis, refers to the quality and effectiveness of the infrastructure, and the ability to maintain the infrastructure, used in the operation of the park in order to adequately protect and preserve vital resources and provide for an effective visitor experience. This includes an analysis of the condition and usefulness of the facilities and developed features used to support the operations of the park. James City County was consulted for information on utilities and community services. Impact analyses are based on the current description of park operations presented in the Affected Environment chapter of this document.

- Negligible: Park operations would not be affected, or the impacts would be at low levels of detection and would not have an appreciable impact on park operations.
- Minor: The impact would be detectable but would be of a magnitude that would not have an appreciable impact on park operations. If mitigation was needed to offset adverse impacts, it would be simple and likely successful.
- Moderate: The impacts would be readily apparent and would result in a substantial change in park operations in a manner noticeable to staff and the public. Mitigation measures would be necessary to offset adverse impacts and would likely be successful.
- Major: The impacts would be readily apparent, would result in a substantial change in park operation in a manner noticeable to staff and the public, and be markedly different from existing operations. Mitigation measures to offset adverse impacts would be needed, would be extensive, and their success could not be guaranteed.

4.9.2 Impacts of Alternative 1 (No Action)

No new infrastructure or community services, such as utilities or waste disposal, would be required at the site, and the park would take no future actions to affect these services. Maintenance practices would remain the same. Archeological investigations at the site would continue as funding permitted. There would be no impact to park operations, infrastructure, or community services.

4.9.3 Impacts of Alternative 2 (NPS Preferred Alternative)

Staffing increases would be required to support the visitor contact area. According to NPS estimates, approximately 9.8 additional FTEs would be required. Volunteers could supplement these activities, relieving pressure on the NPS staff. Seasonal positions would provide additional assistance to the Jamestown curator and Colonial NHP archeologist on short-term curatorial and archeological activities. Additional security FTEs would also be required to provide security to the site while it was open.

Community services and utilities would be extended to the site. Electricity and telephone service would be accessed from the above ground lines on Centerville Road. Water would be accessed from the line

running north of the site and sewage service could be acquired from a line running through the southern portion of the site. All utilities would be installed within the examined access road swath, although the water and sewer lines would require additional excavation and archeological investigations to bring them across the field to the trench. Alternative 2 would have a long-term, moderate, beneficial impact on park operations, infrastructure, and community services.

4.9.4 Impacts of Alternative 3

Alternative 3 would require a minimal increase in staffing to provide visitor support programs. According to NPS estimates, an additional 3.9 FTEs would be required under this alternative. Volunteers could supplement these activities, relieving pressure on the NPS staff. Seasonal positions would provide additional assistance to the Jamestown curator and Colonial NHP archeologist on short-term curatorial and archeological activities. Electricity would be accessed from the utility line running between the facility and Centerville Road. There would be no water, sewage, or telephone utilities at the site. Alternative 3 would have a long-term, minor, beneficial impact on park operations, infrastructure, and community services.

4.9.5 Cumulative Impacts

Ongoing and proposed park projects that would affect park operations and infrastructure include short- and long-term, negligible to moderate, beneficial impacts from future development in James City County; long-term, minor to moderate, beneficial impacts from the Colonial NHP ATS, long-term, minor to moderate, beneficial impacts from the Jamestown Project and work at the Jamestown Settlement, as well as long-term, minor to moderate, beneficial impacts from future development at Green Spring. Development within James City County is ongoing and continuous. This development could result in new utility lines and infrastructure improvements around the Green Spring area. The ATS would result in changes to staffing as well as providing new transportation services on existing roads within and around the units of the park. The Jamestown Project and work at the Jamestown Settlement would also result in changes in staffing and improvements that would require new or enhanced infrastructure elements. Finally, future development at Green Spring could result in additional staffing, utilities, or community services. The overall impact from these projects would be long-term, minor to moderate, and beneficial. The No Action Alternative would not contribute to these impacts. Alternative 2, the NPS Preferred Alternative, would contribute appreciable increments to these cumulative impacts. And, Alternative 3 would contribute noticeable increments to long-term, minor to moderate, beneficial cumulative impacts on park operations, infrastructure, and community services.

4.9.6 Conclusion

The No Action alternative would have **no impact** on park operations, infrastructure, and community services and would not contribute to cumulative impacts. Alternative 2, the NPS Preferred Alternative, would have a **long-term, moderate, beneficial impact** on park operations, infrastructure, and community services and would contribute appreciable increments to long-term, minor to moderate, beneficial cumulative impacts. Alternative 3 would have a **long-term, minor, beneficial impact** on park operations, infrastructure, and community services. It would contribute noticeable increments to cumulative impacts.

Because there would be no major adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the park's establishing legislation, (2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents, there would be no impairment of park resources or values related to park operations, infrastructure, and community services.